

**Data Evaluation Record on the Acute Toxicity of Mancozeb to Terrestrial Vascular Plants:
Seedling Emergence**

PMRA Submission Number {.....}

EPA MRID Number 47486102

Data Requirement: PMRA Data Code: {.....}
 EPA DP Barcode: 360288
 OECD Data Point: {.....}
 EPA Guideline: 850.4100

Test material: Dithane M-45 (AI: Mancozeb)**Purity:** 81%

Common name

Chemical name: IUPAC: Manganese ethylenebis(dithiocarbamate) (polymeric) complex with zinc salt
 CAS name: [[2-[(dithiocarboxy)amino]ethyl]carbamodithioato(2-)-κS,κS']manganese mixture with
 [[2-[(dithiocarboxy)amino]ethyl]carbamodithioato(2-)-κS,κS']zinc
 CAS No.: 8018-01-7
 Synonyms

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 {EPA/OECD/PMRA}

Date: {.....}

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Date Evaluation Completed: {dd-mm-yyyy}

CITATION: Aufderheide, J. 2008. Mancozeb: Effects on the Seedling Emergence of Non-Target Terrestrial Plants (Tier I). Unpublished study performed by ABC Laboratories, Columbia, Missouri. Laboratory project ID: ABC Study No. 63398. Study sponsored by Mancozeb Task Force c/o McDermott, Will and Emery, Washington, D.C.. Mancozeb Task Force Study No. 2007-02. Study completed July 17, 2008.

DISCLAIMER: This document provides guidance for EPA and PMRA reviewers on how to complete a data evaluation record after reviewing a scientific study concerning the acute toxicity of a pesticide to terrestrial vascular plants. It is not intended to prescribe conditions to any external party for conducting this study nor to establish absolute criteria regarding the assessment of whether the study is scientifically sound and whether the study satisfies any applicable data requirements. Reviewers are expected to review and to determine for each study, on a case-by-case basis, whether it is scientifically sound and provides sufficient information to satisfy applicable data requirements. Studies that fail to meet any of the conditions may be accepted, if appropriate; similarly, studies that

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meet all of the conditions may be rejected, if appropriate. In sum, the reviewer is to take into account the totality of factors related to the test methodology and results in determining the acceptability of the study.

EXECUTIVE SUMMARY:

The effect of Mancozeb on the seedling emergence of monocot (corn, *Zea mays*; oat, *Avena sativa*; onion, *Allium cepa*; and ryegrass, *Lolium perenne*) and dicot (cucumber, *Cucumis sativa*; lettuce, *Lactuca sativa*; oilseed rape, *Brassica napus*; soybean, *Glycine max*; radish, *Raphanus sativus*; and tomato, *Lycopersicon esculentum*) crops was studied at nominal concentrations of 0 (negative and solvent controls), and 0.017 lbs ai/A. Measured concentrations were <0.00001 (<LOQ, controls), and 0.02 lbs ai/A.

The growth medium used in the seedling emergence test was a mixture of collected silt and sand soils that were classified as a sandy loam soil (pH 7.8, % organic matter 0.6%). After 21 days, 9 of the species of plants had emerged, and after 28 days, onion had completely emerged. The surviving plants per pot were recorded and taken for measuring dry weight and height.

Survival was 100% in the negative and solvent controls across all species, and ranged from 95 to 100% in the treatment groups. There was promotion of growth in dry weight of 9 of the species tested, with the exception of 19% inhibition in dry weight for ryegrass. There was promotion of growth in plant height in 9 of the species tested, except for one species of plant that exhibited 1% inhibition

No plants exhibited phytotoxic effects.

The most sensitive monocot was ryegrass based on dry weight, with NOAEC and EC₂₅ values of <0.02 lbs ai/A and >0.02 lbs ai/A. The most sensitive dicot species could not be determined due to the lack of an effect on any of the dicot plants.

Maximum Labeled Rate: Not reported

Results Synopsis

Monocot

EC₅₀/IC₅₀: >0.02 lbs ai/A 95% C.I.: N/A
EC₂₅/IC₂₅: >0.02 lbs ai/A 95% C.I.: N/A
EC₀₅/IC₀₅: <0.02 lbs ai/A 95% C.I.: N/A
NOEC: <0.02 lbs ai/A
Slope: N/A Std err: N/A
Most sensitive monocots: Ryegrass
Most sensitive parameter: Dry weight (19% inhibition)

Dicot

EC₅₀/IC₅₀: >0.02 lbs ai/A 95% C.I.: N/A
EC₂₅/IC₂₅: >0.02 lbs ai/A 95% C.I.: N/A
EC₀₅/IC₀₅: >0.02 lbs ai/A 95% C.I.: N/A
NOAEC: 0.02 lbs ai/A
Slope: N/A Std err: N/A
Most sensitive dicot: None
Most sensitive parameter: N/A

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This toxicity study is classified as Acceptable and satisfies the guideline requirement for a Tier I terrestrial plant toxicity study.

Table 1 (Tier I studies). Summary of most sensitive parameters by species at the 0.02 lbs ai/A treatment level.

| Emergence | | | | Survival | | |
|--------------|---------|-----------|-------------|----------|-----------|-------------|
| Species | Control | Treatment | %difference | Control | Treatment | %difference |
| Cucumber | 98 | 100 | 2 | 100 | 100 | 0 |
| Lettuce | 85 | 83 | 2 | 100 | 100 | 0 |
| Soybean | 90 | 95 | -6 | 100 | 100 | 0 |
| Oilseed rape | 98 | 90 | 8 | 100 | 100 | 0 |
| Tomato | 93 | 83 | 11 | 100 | 100 | 0 |
| Radish | 100 | 93 | 7 | 100 | 97 | 3 |
| Corn | 98 | 95 | 3 | 100 | 100 | 0 |
| Oat | 100 | 100 | 0 | 100 | 100 | 0 |
| Onion | 83 | 75 | 10 | 100 | 100 | 0 |
| Ryegrass | 95 | 95 | 0 | 100 | 95 | 5 |

| Dry weight (g) | | | | Plant height (mm) | | |
|----------------|---------|-----------|-------------|-------------------|-----------|-------------|
| Species | Control | Treatment | %difference | Control | Treatment | %difference |
| Cucumber | 0.531 | 0.553 | -4 | 98 | 107 | -9 |
| Lettuce | 0.0608 | 0.0704 | -16 | 86 | 93 | -8 |
| Soybean | 0.9 | 0.914 | -2 | 294 | 291 | 1 |
| Oilseed rape | 0.186 | 0.215 | -16 | 125 | 135 | -8 |
| Tomato | 0.075 | 0.117 | -56 | 60 | 67 | -12 |
| Radish | 0.205 | 0.209 | -2 | 127 | 130 | -2 |
| Corn | 0.758 | 0.788 | -4 | 620 | 644 | -4 |
| Oat | 0.129 | 0.157 | -22 | 319 | 336 | -5 |
| Onion | 0.024 | 0.031 | -29 | 142 | 157 | -11 |
| Ryegrass | 0.016 | 0.013 | 19 | 171 | 176 | -3 |

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED:

This study was conducted according to U.S. EPA Pesticide Assessment Guidelines, Subdivision J, Series 122-1, OPPTS 850.4100 Seedling Emergence (Tier I) and the U.S. EPA Standard Evaluation Procedure, "Non-Target Plants: Seed Germination/Seedling Emergence Tiers 1 and 2", and the ABC protocol. The following deviations from OPPTS 850.4100 were noted:

1. Significant differences were detected between the solvent and negative control for three different species.
2. All species were tested under similar environmental conditions instead of separating the warm-loving species from the cold-loving species.
3. The physiochemical properties of the test material were not reported.

COMPLIANCE:

Signed and dated No Data Confidentiality, GLP, and Quality Assurance statements were provided. This study was conducted in compliance with EPA FIFRA GLP (40 CFR Part 160) with the following exception: The latest water characterizations performed in February 2008.

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A. MATERIALS:

1. Test Material Dithane M-45, GF-1530 (AI: Mancozeb)

Description: Not reported.

Lot No./Batch No. : VC0588R223 (Lot no.)

Purity: 81%

Stability of compound under test conditions: Total recovery of mancozeb was 125% of the nominal application rate at test initiation.
(OECD recommends chemical stability in water and light)

Storage conditions of test chemicals: Test material was stored under ambient conditions.

Table 2. Physical/chemical properties of Mancozeb.

| Parameter | Values | Comments |
|--------------------------|---------------|----------|
| Water solubility at 20EC | Not reported. | |
| Vapor pressure | Not reported. | |
| UV absorption | Not reported. | |
| pKa | Not reported. | |
| Kow | Not reported. | |

2. Test organism:

Monocotyledonous species: Corn (*Zea mays*; X68585), Oat (*Avena sativa*; Ogle), Onion (*Allium cepa*; Yellow Granex Hybrid) and Ryegrass (*Lolium perenne*; Linn); EPA recommends four monocots in two families, including corn.

Dicotyledonous species: Cucumber (*Cucumis sativus*; Straight Eight), Lettuce (*Lactuca sativa*; Grand Rapids), Oilseed Rape (*Brassica napus*; Wichita), Soybean (*Glycine max*; Williams 82), Radish, (*Raphanus sativus*; Crimson Giant), and Tomato (*Lycopersicon esculentum*; Beefsteak); EPA recommends six dicots in four families, including soybean and a root crop.

OECD recommends a minimum of three species selected for testing, at least one from each of the following categories: Category 1: ryegrass, rice, oat, wheat, and sorghum; Category 2: mustard, rape, radish, turnip, and Chinese cabbage; Category 3: vetch, mung bean, red clover, fenugreek, lettuce, and cress.

Seed source: Cucumber, lettuce, radish, and tomato obtained from Meyer Seed Company; oilseed rape obtained from Kansas State University; soybean obtained from Missouri Foundation Seeds; corn obtained from Syngenta Seeds; oat obtained from Ohio Foundation Seed; onion obtained from Henry Field's Seed and Nursery Co.; and ryegrass obtained from Hummert International.

Prior seed treatment/sterilization: Seeds were not treated with fungicides or insecticides prior to test initiation.

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Historical % germination of seed: Radish, 85%; corn, 88%; cucumber, 80%; oat, 99.5%; oilseed rape, 95%; onion, 95%; soybean, 85%; tomato, 90; lettuce, 85%; and ryegrass, 90%

Seed storage, if any: Seeds were stored refrigerated until test initiation.

B. STUDY DESIGN:

1. Experimental Conditions

- a. Limit test:
- b. Range-finding study: A range finding study was not conducted.
- c. Definitive Study

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Table 3: Experimental Parameters - Seedling Emergence.

| Parameters | Seedling Emergence | |
|--|---|---|
| | Details | Remarks |
| | | Criteria |
| Duration of the test | 21 days, except for onion (28 days). | <p>Recommended test duration is 14-21 days.</p> <p>OECD recommends that the test be terminated no sooner than 14 days after 50 percent of the control seedlings have emerged</p> |
| Number of seeds/plants/species/replicate | There were 10 seeds per rep for all species. | <p>Ten seeds per replicate should be used.</p> <p>OECD recommends a minimum of five seeds planted in each replicate within 24 hours of incorporation of the test substance. All seeds of each species for each test should be of the same size class. The seed should not be imbibed.</p> |
| <u>Number of replicates</u> Control: Adjuvant control: Treated: | 4 4 4 | <p>Four replicates per dose should be used.</p> <p>OECD recommends a minimum of four replicates per treatment</p> |
| <u>Test concentrations (lb AI/A)</u> Nominal: Measured: | 0 (negative and solvent controls), and 0.017 lbs ai/A <0.00001 (<LOQ, controls), and 0.02 lbs ai/A | <p>Five test concentrations should be used with a dose range of 2X or 3X progression</p> <p>OECD recommends three concentrations, preferably with application rates equivalent to 0.0 (control), 1.0, 10.0 and 100 mg substance per kg of oven-dried soil.</p> |
| <u>Method and interval of analytical verification</u> LOQ: | Samples were analyzed at test initiation by GC with a flame photometric detector. Reported as the minimum quantifiable limit. 0.00002 lbs/A | |

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| Parameters | Seedling Emergence | | |
|---|--|---|--|
| | Details | Remarks | |
| | | Criteria | |
| LOD: | Not reported. | | |
| Adjuvant (type, percentage, if used) | Latron B-1956 AG, 0.25% | | |
| <u>Test container (pot)</u> | | | |
| Size/Volume | 16.5 cm diameter, 11.5 cm depth | <i>Non-porous containers should be used.</i> <i>OECD recommends that non-porous plastic or glazed pot be used.</i> | |
| Material: (glass/polystyrene) | Plastic | | |
| Growth facility | Greenhouse | | |
| Method/depth of seeding | Seeds were planted at depths of 6 to 20 cm. | | |
| <u>Test material application</u> | | | |
| Application time including the plant growth stage | Test material was applied at time 0. | | |
| Number of application | Each species was treated once | | |
| Application interval | N/A; single application | | |
| Method of application | Test material was sprayed onto the soil surface using an overhead track sprayer equipped with a nozzle (TeeJet 4001E, 40 psi). | | |
| <u>Details of soil used</u> | | | |
| Geographic location | Hartsburg, Missouri (Soil Lot Nos. G82107MOSILT and G82107MOSAND 063001) Soil from the two lots was mixed | | |

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| Parameters | Seedling Emergence | |
|---|--|---|
| | Details | Remarks |
| | | Criteria |
| Depth of soil collection Soil texture % sand % silt % clay pH: % organic carbon CEC Moisture at 1/3 atm (%) | to obtain the test soil 6-10 inches Sandy loam 66 26 8 7.8 0.4 10.2 10.1 | % organic matter: 0.6 Bulk density: 1.35 g/cc (disturbed) <i>Soil mixes containing sandy loam, loam, or clay loam soil with no greater than 2% organic matter are preferable. Glass beads, rock wool, and 100% acid washed sand are not preferred.</i> <i>OECD prefers the soil to be sieved (0.5 cm) to remove coarse fragments. Carbon content should not exceed 1.5% (3% organic matter). Fine particles (under 20um) makeup should be between 10 and 20%. The recommended pH is between 5.0 and 7.5.</i> |
| Details of nutrient medium, if used | N/A | |
| <u>Watering regime and schedules</u> Water source/type: Volume applied: Interval of application: Method of application: | Not reported. Not reported. Not reported. Seedlings were top-watered from 0-2 days, and thereafter were watered via subirrigation using saucers. | <i>EPA prefers that bottom watering be utilized for seedling emergence studies so that the chemical is not leached out of the soil during the test.</i> |
| Any pest control method/fertilization, if used | ½ tablespoon Peters 20-20-20 in 1 gallon of water given twice during the exposure. | |
| <u>Test conditions</u> Temperature: Photoperiod: Light intensity and quality: | 10.2-37.4°C 16L:8D 323.4-544.7 $\mu\text{Em}^{-2}\text{s}^{-1}$ Natural daylight was supplemented by artificial lighting (high pressure sodium lights). | <i>EPA prefers that the cold vs warm loving plants be tested in two separate groups to optimize plant growth.</i> <i>OECD prefers that the temperature, humidity and light conditions be suitable for maintaining normal growth of each species for the test period.</i> |
| Relative humidity: | 7-51% | |

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| Parameters | Seedling Emergence | | |
|--|--------------------|-----------------|--|
| | Details | Remarks | |
| | | <i>Criteria</i> | |
| Reference chemical (if used) Name: Concentrations: | N/A | | |
| Other parameters, if any | None. | | |

2. Observations:

Table 4: Observation Parameters - Seedling Emergence.

| Parameters | Seedling Emergence | | |
|--|---|---------|--|
| | Details | Remarks | |
| Parameters measured (e.g., number of germinated seeds, emerged seedlings, plant height, dry weight or other endpoints) | Emergence, survival, phytotoxicity, dry weight, and shoot length. | | |
| Measurement technique for each parameter | Emergence, survival, and phytotoxicity were assessed visually. Dry weight was measured by removing the shoot portion of the plants from the pots, and weighing each replicate individually. Shoot length for plants with a bulb or leaf rosette was determined by measuring from the base of the stem to the tip of the longest leaf. All other plants were measured from the base of the stem to the apical bud. | | |
| Observation intervals | Emergence, survival, and phytotoxicity were assessed weekly. Dry weight and shoot length were determined at test termination. | | |

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| | | |
|--------------------------------------|---|--|
| Other observations, if any | None. | |
| Were raw data included? | Raw data were included. | |
| Phytotoxicity rating system, if used | 0- No injury; 100- maximum plant effect (mortality) | |

II. RESULTS and DISCUSSION:

A. INHIBITORY EFFECTS:

1. Seedling Emergence:

Negative control emergence ranged from 83 to 100% for all species tested, solvent control emergence ranged from 70% to 100%, and treatment group emergence ranged from 75% to 100%.

Survival was 100% in the negative and solvent controls across all species, and ranged from 95 to 100% in the treatment groups.

There was promotion of growth in dry weight of 9 of the species tested, with the exception of 19% inhibition in dry weight for ryegrass. There was promotion of growth in plant height in 9 of the species tested, except for one species of plant that exhibited 1% inhibition.

No plants exhibited phytotoxic effects.

B. REPORTED STATISTICS:

No statistical analyses were employed.

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Table 5: Reported effect of Mancozeb on Seedling Emergence.

| Species | Results summary for dry weight per plant (lbs ai/A) | | | | | | | | | |
|--------------|---|------|------------------|-------|------------------|-------|------------------|-------|-------|---------|
| | Weight (g) | NOEC | EC ₀₅ | 95%CI | EC ₂₅ | 95%CI | EC ₃₀ | 95%CI | slope | Std err |
| Cucumber | 0.5316-0.5637 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Lettuce | 0.052-0.0965 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Soybean | 0.7947-0.9891 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Oilseed rape | 0.1949-0.2303 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Tomato | 0.1053-0.1405 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Radish | 0.19-0.2213 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Corn | 0.7581-0.8110 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Oat | 0.1507-0.1621 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Onion | 0.0243-0.0357 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Ryegrass | 0.0117-0.0144 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |

NR- not reported

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Table 5a: Reported effect of Mancozeb on Seedling Emergence.

| Species | Results summary for shoot length (lbs ai/A) | | | | | | | | | |
|--------------|---|------|------------------|-------|------------------|-------|------------------|-------|-------|---------|
| | Length (mm) | NOEC | EC ₀₅ | 95%CI | EC ₂₅ | 95%CI | EC ₅₀ | 95%CI | slope | Std err |
| Cucumber | 80-137 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Lettuce | 50-119 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Soybean | 216-352 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Oilseed rape | 86-161 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Tomato | 27-101 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Radish | 89-164 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Corn | 511-784 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Oat | 267-382 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Onion | 78-209 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Ryegrass | 19-254 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |

NR- not reported

Table 5b: Reported effect of Mancozeb on Seedling Emergence.

| Species | Results summary for survival (lbs ai/A) | | | | | | | | | |
|--------------|---|------|------------------|-------|------------------|-------|------------------|-------|-------|---------|
| | Survival % | NOEC | EC ₀₅ | 95%CI | EC ₂₅ | 95%CI | EC ₅₀ | 95%CI | slope | Std err |
| Cucumber | 100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Lettuce | 60-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Soybean | 90-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Oilseed rape | 80-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Tomato | 70-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Radish | 80-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Corn | 90-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Oat | 90-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Onion | 50-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |
| Ryegrass | 80-100 | NR | NR | NR | >0.017 | NR | NR | NR | NR | NR |

NR- not reported

Day 7 Emergence

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| Day 7 Emergence | | | | | | | | | | |
|-----------------|----------|---------|---------|--------------|--------|--------|------|-----|-------|----------|
| Control | Cucumber | Lettuce | Soybean | Oilseed rape | Tomato | Radish | Corn | Oat | Onion | Ryegrass |
| NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |

NR - not reported.

| Day 14 Emergence | | | | | | | | | | |
|------------------|----------|---------|---------|--------------|--------|--------|------|-----|-------|----------|
| Control | Cucumber | Lettuce | Soybean | Oilseed rape | Tomato | Radish | Corn | Oat | Onion | Ryegrass |
| NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |

NR - not reported.

| Day 21 Emergence | | | | | | | | | | |
|------------------|----------|---------|---------|--------------|--------|--------|------|-----|-------|----------|
| Control | Cucumber | Lettuce | Soybean | Oilseed rape | Tomato | Radish | Corn | Oat | Onion | Ryegrass |
| NA | 100 | 83 | 95 | 90 | 83 | 93 | 95 | 100 | 75 | 95 |

NA - not applicable

| Plant Injury Index | | | | | | | | | | |
|--------------------|----------|---------|---------|--------------|--------|--------|------|-----|-------|----------|
| Control | Cucumber | Lettuce | Soybean | Oilseed rape | Tomato | Radish | Corn | Oat | Onion | Ryegrass |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

0- No injury; 100- maximum plant effect (mortality)

C. VERIFICATION OF STATISTICAL RESULTS BY THE REVIEWER:

Any species exhibiting an inhibition of 5% in survival, height or dry weight relative to the negative control was statistically analyzed; toxicity values for all other species and endpoints were determined visually. All analyses were conducted using the negative control. The 0.02 lbs ai/A treatment group was compared to the negative control using a two-tailed t-test in Excel 2003. Before analysis, the reviewer compared the negative and solvent controls if the solvent control had inhibitions or promotions of growth of 5% or greater. All analyses were conducted using the measured application rate in terms of lbs ai/A.

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Table 6: Effect of Mancozeb on Seedling Emergence.

| Species | Results summary for dry weight per plant (lbs ai/A) | | | | | | | | | |
|--------------|---|-------|------------------|-------|------------------|-------|------------------|-------|-------|---------|
| | Weight (g) | NOAEC | EC ₀₅ | 95%CI | EC ₂₅ | 95%CI | EC ₅₀ | 95%CI | slope | Std err |
| Cucumber | 0.5316-0.5637 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Lettuce | 0.052-0.0965 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Soybean | 0.7947-0.9891 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Oilseed rape | 0.1949-0.2303 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Tomato | 0.1053-0.1405 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Radish | 0.19-0.2213 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Corn | 0.7581-0.8110 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Oat | 0.1507-0.1621 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Onion | 0.0243-0.0357 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Ryegrass | 0.0117-0.0144 | <0.02 | <0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |

N/A - not applicable

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Table 6a: Effect of Mancozeb on Seedling Emergence.

| Species | Results summary for shoot length (lbs ai/A) | | | | | | | | | |
|--------------|---|------|------------------|-------|------------------|-------|------------------|-------|-------|---------|
| | Length (mm) | NOEC | EC ₀₅ | 95%CI | EC ₂₅ | 95%CI | EC ₅₀ | 95%CI | slope | Std err |
| Cucumber | 80-137 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Lettuce | 50-119 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Soybean | 216-352 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Oilseed rape | 86-161 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Tomato | 27-101 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Radish | 89-164 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Corn | 511-784 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Oat | 267-382 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Onion | 78-209 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Ryegrass | 19-254 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |

N/A - not applicable

Table 6b: Effect of Mancozeb on Seedling Emergence.

| Species | Results summary for survival (lbs ai/A) | | | | | | | | | |
|--------------|---|------|------------------|-------|------------------|-------|------------------|-------|-------|---------|
| | % | NOEC | EC ₀₅ | 95%CI | EC ₂₅ | 95%CI | EC ₅₀ | 95%CI | slope | Std err |
| Cucumber | 100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Lettuce | 60-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Soybean | 90-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Oilseed rape | 80-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Tomato | 70-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Radish | 80-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Corn | 90-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Oat | 90-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Onion | 50-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |
| Ryegrass | 80-100 | 0.02 | >0.02 | N/A | >0.02 | N/A | >0.02 | N/A | N/A | N/A |

N/A - not applicable

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| Day 21 Emergence | | | | | | | | | | |
|------------------|----------|---------|---------|--------------|--------|--------|------|-----|-------|----------|
| Control | Cucumber | Lettuce | Soybean | Oilseed rape | Tomato | Radish | Corn | Oat | Onion | Ryegrass |
| NA | 100 | 83 | 95 | 90 | 83 | 93 | 95 | 100 | 75 | 95 |

NA – not applicable

| Plant Injury Index | | | | | | | | | | |
|--------------------|----------|---------|---------|--------------|--------|--------|------|-----|-------|----------|
| Control | Cucumber | Lettuce | Soybean | Oilseed rape | Tomato | Radish | Corn | Oat | Onion | Ryegrass |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

0- No injury; 100- maximum plant effect (mortality)

Monocot

EC₅₀/IC₅₀: >0.02 lbs ai/A 95% C.I.: N/A
 EC₂₅/IC₂₅: >0.02 lbs ai/A 95% C.I.: N/A
 EC₀₅/IC₀₅: <0.02 lbs ai/A 95% C.I.: N/A
 NOEC: <0.02 lbs ai/A
 Slope: N/A Std err: N/A
 Most sensitive monocots: Ryegrass
 Most sensitive parameter: Dry weight (19% inhibition)

Dicot

EC₅₀/IC₅₀: >0.02 lbs ai/A 95% C.I.: N/A
 EC₂₅/IC₂₅: >0.02 lbs ai/A 95% C.I.: N/A
 EC₀₅/IC₀₅: >0.02 lbs ai/A 95% C.I.: N/A
 NOAEC: 0.02 lbs ai/A
 Slope: N/A Std err: N/A
 Most sensitive dicot: None
 Most sensitive parameter: N/A

D. STUDY DEFICIENCIES:

Significant differences were detected between the negative and solvent controls for lettuce and tomato height, and corn, lettuce, and tomato dry weight. For lettuce height, even though the solvent control had an inhibition of 17%, the treatment group demonstrated promotion of growth. For tomato height, the solvent control demonstrated promotion of growth of 22%, which was greater than the 12 promotion of growth present in the treatment group. It is possible that there was an effect on this species, but the solvent is masking the effect. For corn dry weight, the solvent control had an inhibition of 11%, while the treatment group demonstrated a 4% promotion of growth. For lettuce dry weight, the solvent control had an inhibition of 22%, while the treatment group demonstrated 16% promotion of growth. For tomato dry weight, both the solvent control and the treatment group demonstrated high percentages of promotion of growth (43 and 56%, respectively). These were the only cases where such differences between the negative and solvent control occurred, and were thus exceptions in this study.

Data Evaluation Record on the Acute Toxicity of Mancozeb to Terrestrial Vascular Plants: Seedling Emergence

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E. REVIEWER'S COMMENTS:

The reviewer's results agreed with the study author's.

The study author divided up the seeds for corn, oat, cucumber, oilseed rape, radish, soybean, and tomato into 2 pots per replicate.

All species were tested under similar environmental conditions.

All species except for onion were tested from February 29 to March 21, 2008. The onion test was performed concurrently, but was extended an additional 7 days due to less than 50% emergence at day 7.

F. CONCLUSIONS:

The study is acceptable. The most sensitive monocot was ryegrass, based on dry weight. The most sensitive dicot species could not be determined due to the lack of an effect on any of the dicot plants.

Most sensitive monocot and EC₂₅: Ryegrass, >0.02 lbs ai/A

Most sensitive dicot and EC₂₅: None, >0.02 lbs ai/A

III. REFERENCES:

- 1 U.S. EPA. 1982. Pesticide Assessment Guidelines, Subdivision J, Hazard Evaluation: Non-target Plants. 1996. OPPTS 850.4100.
- 2 U.S. EPA. 1986. Hazard Evaluation Division. Standard Evaluation Procedure. Non-Target Plants: Seed Germination/Seedling Emergence and Seedling Emergence – Tiers 1 and 2.
- 3 U.S. EPA. Pesticide Reregistration Draft Rejection Rate Analysis: Ecological Effects. Special Review and Registration Division and Environmental Fate and Effects Division. February, 1994.

APPENDIX I. OUTPUT OF REVIEWER'S STATISTICAL VERIFICATION:

| <i>Ryegrass dry weight</i> | <i>Neg ctrl</i> | <i>0.02 lb ai/A</i> |
|------------------------------|-----------------|---------------------|
| Mean | 0.0161 | 0.0129 |
| Variance | 4.61E-06 | 1.24667E-06 |
| Observations | 4 | 4 |
| Pooled Variance | 2.93E-06 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | 2.645321 | |
| P(T<=t) one-tail | 0.019134 | |
| t Critical one-tail | 1.94318 | |
| P(T<=t) two-tail | 0.038267 | |

Data Evaluation Record on the Acute Toxicity of Mancozeb to Terrestrial Vascular Plants: Seedling Emergence

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t Critical two-tail 2.446912

| <i>Ryegrass survival</i> | <i>Neg control</i> | <i>0.02 lb ai/A</i> |
|--------------------------|--------------------|---------------------|
| Mean | 95 | 90 |
| Variance | 33.33333333 | 66.66666667 |
| Observations | 4 | 4 |
| Pooled Variance | 50 | |
| Hypothesized Mean | | |
| Difference | 0 | |
| df | 6 | |
| t Stat | 1 | |
| P(T<=t) one-tail | 0.177958842 | |
| t Critical one-tail | 1.943180274 | |
| P(T<=t) two-tail | 0.355917684 | |
| t Critical two-tail | 2.446911846 | |

| <i>Ryegrass dry weight</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|----------------------------|-----------------|------------------|
| Mean | 0.0161 | 0.022 |
| | | 3.96E- |
| Variance | 4.61E-06 | 05 |
| Observations | 4 | 4 |
| Pooled Variance | 2.21E-05 | |
| Hypothesized Mean | | |
| Difference | 0 | |
| df | 6 | |
| t Stat | -1.77435 | |
| P(T<=t) one-tail | 0.06318 | |
| t Critical one-tail | 1.94318 | |
| P(T<=t) two-tail | 0.126361 | |
| t Critical two-tail | 2.446912 | |

Data Evaluation Record on the Acute Toxicity of Mancozeb to Terrestrial Vascular Plants: Seedling Emergence

PMRA Submission Number {.....}

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| <i>Onion plant height</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 141.75 | 133 |
| Variance | 68.25 | 516.6666667 |
| Observations | 4 | 4 |
| Pooled Variance | 292.4583333 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | 0.723587491 | |
| P(T<=t) one-tail | 0.248274141 | |
| t Critical one-tail | 1.943180274 | |
| P(T<=t) two-tail | 0.496548281 | |
| t Critical two-tail | 2.446911846 | |

| <i>Ryegrass plant height</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 161.25 | 183 |
| Variance | 144.9166667 | 629.3333333 |
| Observations | 4 | 4 |
| Pooled Variance | 387.125 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | -1.56332276 | |
| P(T<=t) one-tail | 0.084503661 | |
| t Critical one-tail | 1.943180274 | |
| P(T<=t) two-tail | 0.169007322 | |
| t Critical two-tail | 2.446911846 | |

| <i>Cucumber height</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 98.25 | 107.5 |
| Variance | 56.25 | 56.33333333 |
| Observations | 4 | 4 |
| Pooled Variance | 56.29166667 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | -1.74355109 | |
| P(T<=t) one-tail | 0.065930669 | |
| t Critical one-tail | 1.943180274 | |
| P(T<=t) two-tail | 0.131861339 | |
| t Critical two-tail | 2.446911846 | |

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PMRA Submission Number {.....}

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| <i>Lettuce height</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 85.75 | 71.5 |
| Variance | 62.91666667 | 8.333333333 |
| Observations | 4 | 4 |
| Pooled Variance | 35.625 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | 3.376388603 | |
| P(T<=t) one-tail | 0.007462097 | |
| t Critical one-tail | 1.943180274 | |
| P(T<=t) two-tail | 0.014924194 | |
| t Critical two-tail | 2.446911846 | |

| <i>Radish height</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 123.25 | 120.25 |
| Variance | 52.25 | 8.916666667 |
| Observations | 4 | 4 |
| Pooled Variance | 30.58333333 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | 0.767173943 | |
| P(T<=t) one-tail | 0.236038519 | |
| t Critical one-tail | 1.943180274 | |
| P(T<=t) two-tail | 0.472077039 | |
| t Critical two-tail | 2.446911846 | |

| <i>Tomato height</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 59.75 | 73 |
| Variance | 5.583333333 | 47.33333333 |
| Observations | 4 | 4 |
| Pooled Variance | 26.45833333 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | -3.64292 | |
| P(T<=t) one-tail | 0.005398585 | |
| t Critical one-tail | 1.943180274 | |
| P(T<=t) two-tail | 0.01079717 | |
| t Critical two-tail | 2.446911846 | |

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PMRA Submission Number {.....}

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| <i>Corn dry weight</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 0.7581 | 0.674325 |
| Variance | 0.0015 | 0.001685 |
| Observations | 4 | 4 |
| Pooled Variance | 0.001592 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | 2.968896 | |
| P(T<=t) one-tail | 0.012497 | |
| t Critical one-tail | 1.94318 | |
| P(T<=t) two-tail | 0.024993 | |
| t Critical two-tail | 2.446912 | |

| <i>Oat dry weight</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 0.128775 | 0.140875 |
| Variance | 0.000156 | 1.38E-05 |
| Observations | 4 | 4 |
| Pooled Variance | 8.49E-05 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | -1.85727 | |
| P(T<=t) one-tail | 0.056325 | |
| t Critical one-tail | 1.94318 | |
| P(T<=t) two-tail | 0.11265 | |
| t Critical two-tail | 2.446912 | |

| <i>Lettuce dry weight</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|------------------------------|-----------------|------------------|
| Mean | 0.06075 | 0.047325 |
| Variance | 4.72E-05 | 1.01E-05 |
| Observations | 4 | 4 |
| Pooled Variance | 2.86E-05 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | 3.547692 | |
| P(T<=t) one-tail | 0.006053 | |
| t Critical one-tail | 1.94318 | |
| P(T<=t) two-tail | 0.012106 | |
| t Critical two-tail | 2.446912 | |

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| <i>Tomato dry weight</i> | <i>Neg ctrl</i> | <i>Solv ctrl</i> |
|---------------------------------|-----------------|------------------|
| Mean | 0.07475 | 0.106525 |
| Variance | 5.67E-05 | 0.000285 |
| Observations | 4 | 4 |
| Pooled Variance | 0.000171 | |
| Hypothesized Mean Difference | 0 | |
| df | 6 | |
| t Stat | -3.438 | |
| P(T<=t) one-tail | 0.006917 | |
| t Critical one-tail | 1.94318 | |
| P(T<=t) two-tail | 0.013835 | |
| t Critical two-tail | 2.446912 | |